DISCUSSION

Grouping Pupils According to Ability. The mortality in ninth year mathematics is relatively large in the average high school. Some of the reasons for this state of affairs are (1) the course of study is too traditional; (2) the work is not made cumulative with respect to the work that has been done in the seventh and eighth grades; (3) many pupils have not learned how "to study" mathematics before they reach the ninth grade; (4) many pupils have been promoted to the ninth year because they are either unable or unwilling to do the work in the eighth year satisfactorily.

Statistics show that pupils in the ninth year range in mental age from ten and one-half years to sixteen and even as high as eighteen years. West Technical High School is no exception in this respect. We have in the past been attempting to compel every student to do the same kind of work, in the same way, under the same kind of instructions. Such a procedure, however, is folly; yea, it is dangerous; furthermore, it is unfair to the majority of pupils. On the one hand, it does not give the pupil of lower mentality a chance at all; his time is practically wasted. On the other hand, it gives the pupil of super-normal ability no incentive, but encourages him to become an incessant loafer. It is the business of a school to give every pupil an inspiration and an incentive to work toward a "top-notch" goal, an ideal absolutely impossible under the old system.

For two semesters we have placed the pupils in the 9-B and 9-A classes, at West Technical High School, into three groups; viz., (1) group (a), group (b), and group (c); or the super-normal group, the normal group, and the sub-normal group. The classification of pupils for these groups is based upon three main facts; viz., (1) their rank as indicated by certain intelligence test; (2) their rank as indicated by certain diagnostic tests; and (3) upon the teacher's estimate of the pupil's ability.

At least two or three classes of the same grade are scheduled the same period; so that the various groups may have their work simultaneously, which permits an easy shift from one group to another, according to the kind of work the pupil is doing.

The pupil is told frankly, and in all sincerity, the group to which he belongs, and that he may be placed into a stronger group at any time that he shows sufficient ability; and vice versa.

In this classification, group (a) is given not only the minimum requirement of the course of study as laid out by the Board of Education, but also the work recommended to be omitted because of lack of time, and much additional work planned by the teacher. In some cases pupils work out special mathematical "projects." These pupils will eventually become the leaders in the various walks of life.

Group (b) is given the minimum requirement of the course of study. In some cases some additional work can be done.

Group (c) is given a more differentiated course. The pupils in this group take the simplest types of problems in the regular course, and then fill in with more concrete material of mensurational geometry and arithmetic, as well as giving more time to drill upon the four fundamental operations with integral and fractional numbers.

Pupils, in this group, who do their work conscientiously, are given a passing credit, and their mark on the permanent record card indicates a special credit. At the end of the ninth year, these pupils are advised to discontinue their mathematics and pursue other lines of work, which function more satisfactorily than mathematics. If, however, such a pupil insists that he must continue his mathematics, he is required to take the regular 9-A course and do the work satisfactorily, before he attempts the course in demonstrative geometry.

Suffice it to say here that the pupils in the tenth year are classified into two groups; viz., group (a) and (b). After the tenth year the courses in mathematics are entirely elective, except for certain specialized courses, and no further grouping is necessary.

This method of grouping pupils according to ability has proved very successful and satisfactory at West Technical High School. The following are some of the benefits derived from it:

1. Pupils are happier because they can progress more rapidly together in their own group.

2. The more brilliant pupils are not learning lazy habits; it gives them a goal for which to work.

3. Pupils who are inclined to work more slowly do not rush over unlearned fundamentals in an attempt to keep up.

4. The curriculum can be adapted to individual differences, and hence the work can be made to function.

5. The method of teaching can be varied to suit. It is obvious that the same method is not successful with both the accelerated and the slow pupil. Many a pupil has been taught to be a loafer under the old system.

6. Teachers are much happier in their work, because they feel that they can have at least some standard of achievement.

7. The percentage of failures has been reduced from more than 30% to less than 10%. As the system is perfected from time to time, the percentage of failures may be reduced to a negligible quantity.

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Tennis Ball Geometry. What better thing than that a ''dead'' tennis ball, of the vintage of 1921, should by ''dead''—section teach the true inwardness of the sphere to his young master!

> I hold it truth, with him who sings
> To one clear harp in divers tones,
> That balls may rise on stepping-stones
> Of their dead selves to higher things.
> —With apologies to Tennyson.

For example:

1. To describe a circumference (horizon circle) on a sphere with a given pole (zenith) and a given polar chord.

A tennis ball and a compass.

2. To find the radius of the circle described above. Mark three points on the circumference. With the compass construct on a separate sheet a congruent triangle (three sides respectively equal). Find the circumcenter of this triangle. Draw the circumscribed circle. Check. Cut this circle out. The hole should fit *closely* the circle on the tennis ball.

3. To find the diameter of a sphere (tennis ball).

Take a section through the axis of the circle. Make a cut-out on cardboard. The tennis ball should just pass through. If not, repeat.

4. Describe parallel circles and hence construct a zone.

Use the same pole.

5. Construct a line.

Use the great circle cut out of 3. Etc.

6. Each face angle of a central polyhedral angle is measured by the subtended side of its spherical polygon.

Lay out on cardboard, that will fold, consecutively four angles of quite distinct size as *e. g.*, 30°, 60°, 90° and 120°. With common vertex as a center and radius equal to that of the ball describe circle. Cut out, fold and paste. Mark and cut out corresponding spherical polygon from ball. Cut out an opposite polygon. Cut out a third congruent polygon.

7. Each dihedral angle of a central polyhedral angle has the same measure as the corresponding spherical angle of its spherical polygon. cf. 6. Etc.

8. Opposite spherical polygons are symmetric. "Symmetry vs. Congruence." Use the polygons of 6. Etc.

9. Two isosceles symmetric spherical triangles are congruent. After the cut outs are fitted the proof is but an incident. Etc.

10. What are polar triangles? Use the great circle cut out and apply the definition. Etc.

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